



PATENT APPLICATION
ATTORNEY DOCKET NO. 200206465-1

IN THE UNITED STATES PATENT & TRADEMARK OFFICE

<p>ART UNIT: 2826</p> <p>EXAMINER: Tan N. Tran</p> <p>APPLICANT: Ashton et al.</p> <p>SERIAL NO.: 10/673,003</p> <p>FILED: September 26, 2003</p> <p>CONFRM. NO.: 9774</p> <p>FOR: ULTRA-HIGH DENSITY STORAGE DEVICE USING PHASE CHANGE DIODE MEMORY CELLS AND METHODS OF FABRICATION THEREOF</p> <p>DOCKET NO. 200206465-1</p>	<p>RESPONSE/AMENDMENT</p> <p>CERTIFICATE OF MAILING UNDER 37 C.F.R. § 1.8</p> <p>DATE OF DEPOSIT: <u>Aug 15, 05</u></p> <p>I hereby certify that this paper or fee (along with any paper or fee referred to as being attached or enclosed) is being deposited with the United States Postal Service with sufficient postage as first class mail on the date indicated above and is addressed to: Commissioner for Patents, P.O. Box 1450, Alexandria, VA 22313-1450.</p> <p><u>Vaughn W. North</u> Vaughn W. North</p>
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DECLARATION OF VAUGHN NORTH
UNDER 37 C.F.R. § 1.131

Assistant Commissioner of Patent and Trademarks
Washington, D.C. 20231

I, Vaughn North, declare as follows:

1. I am a registered patent attorney with the law firm of Thorpe North and Western.
2. Hewlett Packard contracted with the law firm of Thorpe North and Western for the preparation and filing of the above-captioned patent application prior to May 1, 2003, the effective date of the Chaiken '499 Published Patent Application.

3. Exhibit 3, attached hereto, is a redacted copy of a Request for Quote document signed by myself and Hewlett Packard prior to May 1, 2003.

4. I worked diligently with other attorneys at Thorpe North and Western, attorneys at Hewlett Packard, and the named co-inventors to prepare and file the above-captioned patent application from a date prior to May 1, 2003 until the filing date of September 26, 2003.

5. Preparation of the above-captioned patent application coincided with work performed on a reasonable backlog of unrelated cases which were taken up in chronological order, with the work carried out expeditiously.

6. Attorney-client communications between Thorpe North and Western and attorneys and the co-inventors at Hewlett Packard occurred between May 1, 2003 and September 26, 2003. Each communication was accompanied by attorney preparations before and/or after these dates. This disclosure is made without waving attorney-client privilege. Communications occurred on, but were not limited to, the following dates:

- A series of communications prior to the date of May 1, 2003 between the inventor Gary Ashton and Ron Thurman of Thorpe North and Western, who was working for Vaughn North, relating to the preparation of the patent application.
- A communication between Vaughn North and Philip Lyren of Hewlett Packard on June 2, 2003 concerning changes made in the specification of the application.

- A fax from Philip Lyren to Vaughn North on July 19th, 2003 pursuant to revisions of the application.
- A communication between Vaughn North and Philip Lyren on July 26th, 2003 pursuant to the review changes made in the application.

7. The patent application for the invention in the above-captioned patent application was filed with the United States Patent and Trademark Office on September 26, 2003.

I declare that all statements made herein of my own knowledge are true and that all statements made on information and belief are believed to be true; and further that these statements were made with the knowledge that willful, false statements and the like so made are punishable by fine or imprisonment, or both, under Section 1001 of Title 18 of the United States Code, and that such willful, false statement may jeopardize the validity of the application or any patent issuing thereon.

DATED this 15 day of August, 2005.



Vaughn W. North



PATENT APPLICATION
ATTORNEY DOCKET NO. 200206465-1

IN THE UNITED STATES PATENT & TRADEMARK OFFICE

ART UNIT: 2826

EXAMINER: Tan N. Tran

APPLICANT: Ashton et al.

SERIAL NO.: 10/673,003

FILED: September 26, 2003

CONFRM. NO.: 9774

FOR: ULTRA-HIGH DENSITY STORAGE
DEVICE USING PHASE CHANGE DIODE
MEMORY CELLS AND METHODS OF
FABRICATION THEREOF

DOCKET NO. 200206465-1

RESPONSE/AMENDMENT

CERTIFICATE OF MAILING UNDER 37 C.F.R. § 1.13
DATE OF DEPOSIT: <i>Aug 15, 05</i>
I hereby certify that this paper or fee (along with any paper or fee referred to as being attached or enclosed) is being deposited with the United States Postal Service with sufficient postage as first class mail on the date indicated above and is addressed to: Commissioner for Patents, P.O. Box 1450, Alexandria, VA 22313-1450.
<i>Vaughn W. North</i> Vaughn W. North

DECLARATION OF GARY R. ASHTON
UNDER 37 C.F.R. § 1.131

Assistant Commissioner of Patent and Trademarks
Washington, D.C. 20231

I, Gary R. Ashton, declare as follows:

1. I am a named co-inventor in the above-captioned patent application and of the subject matter described and claimed therein.
2. The invention as described and claimed in the above-captioned US patent application No. 10/673,003 was conceived in the United States by myself and Robert J. Davidson,

Approved
MLT 2/16/06

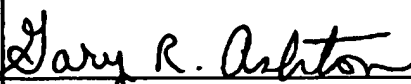
collaborating as co-inventors, prior to May 1, 2003, the effective date of the Chaiken '499 Published Patent Application.

3. Exhibit 2, attached hereto, is a redacted copy of the invention disclosure for the invention described and claimed in the above-captioned patent application that was prepared and signed by myself and Robert J. Davidson prior to May 1, 2003. Accordingly, Exhibit 2 shows that the invention described and claimed in the above-captioned patent application was conceived prior to the effective date of May 1, 2003 of the Chaiken 499 Published Patent Application.

4. The invention disclosure of Exhibit 2 was submitted to Hewlett Packard for the preparation and filing of the above-captioned patent application prior to May 1, 2003.

I declare that all statements made herein of my own knowledge are true and that all statements made on information and belief are believed to be true; and further that these statements were made with the knowledge that willful, false statements and the like so made are punishable by fine or imprisonment, or both, under Section 1001 of Title 18 of the United States Code, and that such willful, false statement may jeopardize the validity of the application or any patent issuing thereon.

DATED this 11 day of August, 2005.



Gary R. Ashton

Best Available Copy

Page 3 of 3



PATENT APPLICATION
ATTORNEY DOCKET NO. 200206465-1

IN THE UNITED STATES PATENT & TRADEMARK OFFICE

<p>ART UNIT: 2826</p> <p>EXAMINER: Tan N. Tran</p> <p>APPLICANT: Ashton et al.</p> <p>SERIAL NO.: 10/673,003</p> <p>FILED: September 26, 2003</p> <p>CONFRM. NO.: 9774</p> <p>FOR: ULTRA-HIGH DENSITY STORAGE DEVICE USING PHASE CHANGE DIODE MEMORY CELLS AND METHODS OF FABRICATION THEREOF</p> <p>DOCKET NO. 200206465-1</p>	<p>RESPONSE/AMENDMENT</p> <p>CERTIFICATE OF MAILING UNDER 37 C.F.R. § 1.8</p> <p>DATE OF DEPOSIT: <u>Aug 15, 2003</u></p> <p>I hereby certify that this paper or fee (along with any paper or fee referred to as being attached or enclosed) is being deposited with the United States Postal Service with sufficient postage as first class mail on the date indicated above and is addressed to: Commissioner for Patents, P.O. Box 1450, Alexandria, VA 22313-1450.</p> <p><u>Vaughn W. North</u> Vaughn W. North</p>
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DECLARATION OF ROBERT J. DAVIDSON
UNDER 37 C.F.R. § 1.131

Assistant Commissioner of Patent and Trademarks
Washington, D.C. 20231

I, Robert J. Davidson, declare as follows:

1. I am a named co-inventor in the above-captioned patent application and of the subject matter described and claimed therein.

2. The invention as described and claimed in the above-captioned US patent application No. 10/673,003 was conceived in the United States by myself and Gary R. Ashton, collaborating as co-inventors, prior to May 1, 2003, the effective date of the Chaiken '499 Published Patent Application.

3. Exhibit 2, attached hereto, is a redacted copy of the invention disclosure for the invention described and claimed in the above-captioned patent application that was prepared and signed by myself and Gary R. Ashton prior to May 1, 2003. Accordingly, Exhibit 2 shows that the invention described and claimed in the above-captioned patent application was conceived prior to the effective date of May 1, 2003 of the Chaiken 499 Published Patent Application.

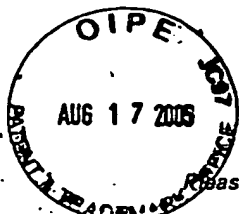
4. The invention disclosure of Exhibit 2 was submitted to Hewlett Packard for the preparation and filing of the above-captioned patent application prior to May 1, 2003.

I declare that all statements made herein of my own knowledge are true and that all statements made on information and belief are believed to be true; and further that these statements were made with the knowledge that willful, false statements and the like so made are punishable by fine or imprisonment, or both, under Section 1001 of Title 18 of the United States Code, and that such willful, false statement may jeopardize the validity of the application or any patent issuing thereon.

DATED this 12th day of August, 2005.


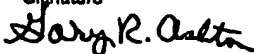

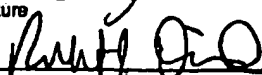


Robert J. Davidson



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	INVENTION DISCLOSURE	PAGE ONE OF <u>1</u>			
PDNO <u>200206465</u>	DATE RCVD <u>HP BOISE LEGAL</u>	ATTORNEY <u>AJB</u>			
<small>Instructions: The information contained in this document is COMPANY CONFIDENTIAL and may not be disclosed to others without prior authorization. Submit this disclosure to the HP Legal Department as soon as possible. No patent protection is possible until a patent application is authorized, prepared, and submitted to the Government.</small>					
Descriptive Title of Invention: Using Copper Indium Gallium Selenide (CIGS) material as the phase change portion of an ARS media diode					
Name of Project: ORCA-ARS (Atomic Resolution Storage)					
Product Name or Number: None yet					
Was a description of the invention published, or are you planning to publish? If so, the date(s) and publication(s): No					
Was a product including the invention announced, offered for sale, sold, or is such activity proposed? If so, the date(s) and location(s): No					
Was the invention disclosed to anyone outside of HP, or will such disclosure occur? If so, the date(s) and name(s): Rommel Noufi at NREL in Golden Colorado. At a future date.					
<small>If any of the above situations will occur within 3 months, call your IP attorney or the Legal Department now at 1-888-4919 or 870-898-4919.</small>					
Was the invention described in a lab book or other record? If so, please identify (lab book #, etc.) NREL Teleconference and at ARS media team teleconference.					
Was the invention built or tested? If so, the date: In the planning stages of this. Partial test in Bob Davidson's laser system. Surface layer only - no diode tests. CIGS is a typical material made for solar cells. This invention pertains to CIGS's application as a phase change data storage material.					
Was this invention made under a government contract? If so, the agency and contract number: We do not know this for sure. We contracted with NREL (the government) to make some diode devices with this material as the substrate. The sample we tested used in the laser system was obtained from NREL under this contract.					
Description of Invention: Please preserve all records of the invention and attach additional pages for the following. Each additional page should be signed and dated by the inventor(s) and witness(es). A. Description of the construction and operation of the invention (include appropriate schematic, block, & timing diagrams; drawings; samples; graphs; flowcharts; computer listings; test results; etc.) B. Advantages of the invention over what has been done before. C. Problems solved by the invention. D. Prior solutions and their disadvantages (if available, attach copies of product literature, technical articles, patents, etc.).					
Signature of Inventor(s): Pursuant to my (our) employment agreement, I (we) submit this disclosure on this date: []					
Employee No.	Name	Signature	Telnet	Mailstop	Entity & Lab Name
524999	Gary R. Ashton		396-5323	400	4800 PSB
352142	Curtis Gonzales		3967121	400	4800 PSB
48788	Robert J. Davidson		3962220	400	4800 PSB
Employee No.	Name	Signature	Telnet	Mailstop	Entity & Lab Name
<small>(If more than four inventors, include additional information on another copy of this form and attach to this document)</small>					

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Invention Disclosure		COMPANY CONFIDENTIAL	PAGE ____ OF ____
Signature of Witness(es): (Please try to obtain the signature of the person(s) to whom invention was first disclosed.)			
The invention was first explained to, and understood by, me (us) on this date: [_____]			
Full Name <i>Richard Lee Hilton</i>	Signature <i>Richard Lee Hilton</i>	Date of Signature _____	
Full Name <i>Thomas Wagnelues</i>	Signature <i>TWagnelues</i>	Date of Signature _____	
Inventor & Home Address Information: (If more than four inventors, include addl. information on a copy of this form & attach to this document)			
Inventor's Full Name Gary Ray Ashton			
Street 1177 N Hillonhead Way			
City Eagle, ID 83618		State	Zip
Do you have a Residential P.O. Address? P.O. BOX NO	City	State	Zip
Greeted as (nickname, middle name, etc.) Gary Ashton		Citizenship USA	
Inventor's Full Name Robert J. Davidson			
Street 1216 N. 21st Street			
City Boise, ID 83702		State	Zip
Do you have a Residential P.O. Address? P.O. BOX No	City	State	Zip
Greeted as (nickname, middle name, etc.) Bob Davidson		Citizenship USA	
Inventor's Full Name Curtis Gonzales			
Street 3425 W. Bescon Light			
City Eagle, ID 83618		State	Zip
Do you have a Residential P.O. Address? P.O. BOX No	City	State	Zip
Greeted as (nickname, middle name, etc.) Curl Gonzales		Citizenship USA	
Inventor's Full Name			
Street			
City		State	Zip
Do you have a Residential P.O. Address? P.O. BOX	City	State	Zip
Greeted as (nickname, middle name, etc.)		Citizenship	

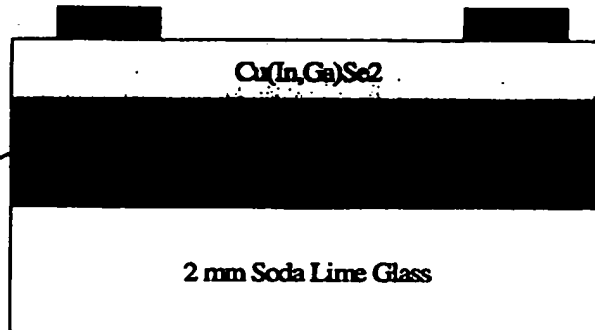
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Description of Invention: Please preserve all records of the invention and attach additional pages for the following. Each additional page should be signed and dated by the inventor(s) and witness(es).

A. Description of the construction and operation of the invention (include appropriate schematic, block, & timing diagrams; drawings; samples; graphs; flowcharts; computer listings; test results; etc)

CIGS refers to "copper indium gallium disulfide" of formula $\text{Cu}(\text{In,Ga})\text{Se}_2$. See High-efficiency $\text{CuIn}_x\text{Ga}_{1-x}\text{Se}_2$ solar cells made from $(\text{In}_x\text{Ga}_{1-x})_2\text{Se}_3$ precursor films in Applied Physics Letters, July 11, 1994, Volume 65, Issue 2, pp. 198-200. Also refer to HP invention disclosure: 100201669 - "ARS Diode Media Made Of Indium Selenide And $\text{Cu}(\text{In,Ga})\text{Se}_2$ ". We have demonstrated that a laser beam can write on the standard NREL CIGS composition and that is possible to cycle the written areas between amorphous and crystalline states. This leads to the idea that a diode as shown in invention disclosure 100201669 turned upside down can be used as the storage media in an ARS diode construction. Because it is no longer needed to store bits, other semiconductor materials can now replace the Indium Selenide layer in the diode shown in invention disclosure 100201669 as long as they produce "good" diodes for ARS media purposes.

Could be CIGS layer or
other semiconductor too



B. Advantages of the invention over what has been done before

CIGS has better electrical properties than indium selenide. The replacement of indium selenide opens up a wider range of materials for the other part of the diode junction including CIGS doped in the opposite carrier type.

It appears that CIGS can be written on and cycled easier than indium selenide.

There are two novel ideas presented in this disclosure.

1. The use of CIGS material as a phase change data storage material; both using lasers and electrons as the heat source.
2. The diode structure using CIGS material to detect the written bit.

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C. Problems solved by the invention.

CIGS is easier to cycle in phase than indium selenide and has superior electrical properties for making diodes.

D. Prior solutions and their disadvantages (if available, attach copies of product literature, technical articles, patents, etc.).

There have been many diodes made by HP in the ORCA program using indium selenide compounds for the phase change layer. These diodes and the indium selenide compounds have not worked as well as we would like. The diode electrical properties have not been good and the indium selenide phase change material has not been easy to write and cycle.



Exhibit 1 Declaration of Applicants